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JIGISH D TRIVEDI

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EXAMINER

PERALTA, GINETTE

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 04/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 08/915,658	Applicant(s) TRIVEDI, JIGISH D	
	Examiner Ginette Peralta	Art Unit 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 February 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 3149 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 31-49 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claim 43 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 43 depends on claim 43, therefore it does not further limit any previous claims

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 31-35, 37, 41-45, and 48-49 are rejected under 35 U.S.C. 102(b) as being anticipated by Chung et al. (U. S. Pat. 5,094,981).

Regarding claim 31, Chung et al. discloses in Fig. 1e a local interconnect that comprises a composite structure comprising a first metal silicide (38A, 38B as disclosed in col. 5, lines 20-33), a second metal silicide (40A, 40B as disclosed in col. 5, lines 50-66, and col. 7, lines 53-55), and an intermetallic compound (36A, 36B as

disclosed in col. 4, lines 55-57) reducing the resistance of the local interconnect, wherein the intermetallic compound comprises metal from the first metal silicide (in this case the first metal silicide is titanium silicide and the first metal is titanium as disclosed in col. 4, lines 55-57) and metal from the second metal silicide (in this case the second metal silicide is tungsten silicide and the second metal is tantalum as disclosed in col. 7, lines 53-55, and col. 4, lines 55-57), wherein the intermetallic compound (36A, 36B) contains no non-metallic materials.

Regarding claim 32, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide and the second metal silicide each comprise at least one refractory metal (titanium and tungsten).

Regarding claim 33, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide and the second metal silicide comprises titanium and tungsten.

Regarding claim 34, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide comprises titanium silicide and the second metal silicide comprises tungsten silicide.

Regarding claim 35, Chung et al. discloses in Fig. 1e a local interconnect for connecting a first active semiconductor region to a second active semiconductor region on a substrate assembly, the first and second active semiconductor regions being separated by an insulating region (32), the local interconnect comprises a composite structure comprising a first refractory metal

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silicide (38A, 38B as disclosed in col. 5, lines 20-33), a second refractory metal silicide (40A, 40B as disclosed in col. 5, lines 50-66, and col. 7, lines 53-55), and an intermetallic compound (36A, 36B as disclosed in col. 4, lines 55-57) reducing the resistance of the local interconnect, wherein the intermetallic compound comprises refractory metal from the first refractory metal silicide (*in this case the first metal silicide is titanium silicide and the first metal is titanium as disclosed in col. 4, lines 55-57*) and refractory metal from the second refractory metal silicide (*in this case the second metal silicide is tungsten silicide and the second metal is tantalum as disclosed in col. 7, lines 53-55, and col. 4, lines 55-57*), the refractory metal from the first refractory metal silicide being different from the refractory metal from the second refractory metal silicide, and wherein the intermetallic compound (36A, 36B) contains no non-metallic materials.

Regarding claim 37, Chung et al. discloses in Fig. 1e a semiconductor device that comprises a substrate assembly having at least one semiconductor layer (10); at least one field effect transistor (22) formed in the at least one semiconductor layer (10), the at least one field effect transistor (22) having a source (18), a drain (18), and a gate (22); and a local interconnect that comprises a composite structure comprising a first refractory metal silicide (38A, 38B as disclosed in col. 5, lines 20-33), a second refractory metal silicide (40A, 40B as disclosed in col. 5, lines 50-66, and col. 7, lines 53-55), and an intermetallic compound (36A, 36B as disclosed in col. 4, lines 55-57) reducing the resistance of

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the local interconnect, wherein the intermetallic compound comprises refractory metal from the first refractory metal silicide (*in this case the first metal silicide is titanium silicide and the first metal is titanium as disclosed in col. 4, lines 55-57*) and refractory metal from the second refractory metal silicide (*in this case the second metal silicide is tungsten silicide and the second metal is tantalum as disclosed in col. 7, lines 53-55, and col. 4, lines 55-57*), wherein the intermetallic compound (36A, 36B) contains no non-metallic materials.

Regarding claim 41, Chung et al. discloses in Fig. 1e a local interconnect that comprises a composite structure comprising a first metal silicide (38A, 38B as disclosed in col. 5, lines 20-33), a second metal silicide (40A, 40B as disclosed in col. 5, lines 50-66, and col. 7, lines 53-55), and an intermetallic compound (36A, 36B as disclosed in col. 4, lines 55-57) reducing the resistance of the local interconnect, wherein the intermetallic compound comprises metal from the first metal silicide (*in this case the first metal silicide is titanium silicide and the first metal is titanium as disclosed in col. 4, lines 55-57*) and metal from the second metal silicide (*in this case the second metal silicide is tungsten silicide and the second metal is tantalum as disclosed in col. 7, lines 53-55, and col. 4, lines 55-57*), wherein the intermetallic compound (36A, 36B) contains no non-metallic materials. Regarding the limitation of “an intermetallic compound formed by a reaction between said first metal silicide and said second metal silicide”, the “formed by” part of the limitation is not considered since the method of forming a device is not germane to the issue of

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patentability of the device itself and since Chung et al. discloses the claimed structure. Therefore, this limitation has not been given patentable weight.

Regarding claim 42, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide comprises titanium silicide and the second metal silicide comprises tungsten silicide.

Regarding claim 43, Chung et al. discloses in col. 4, lines 55-57 that the intermetallic compound comprises titanium tungsten.

Regarding claim 44, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide comprises titanium silicide and the second metal silicide comprises tungsten silicide.

Regarding claim 45, Chung et al. discloses in col. 4, lines 55-57 that the intermetallic compound comprises titanium tungsten.

Regarding claim 48, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide comprises titanium silicide and the second metal silicide comprises tungsten silicide.

Regarding claim 49, Chung et al. discloses in col. 4, lines 55-57 that the intermetallic compound comprises titanium tungsten.

Claim Rejections - 35 USC § 103

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

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5. Claims 36, 38-40 and 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chung et al. in view of Okamoto (U. S. Pat. 4,910,578).

Regarding claim 36, Chung et al. discloses that the composite structure that comprises the first metal silicide (38A, 38B), the second metal silicide (40A, 40B), and an intermetallic compound (36A, 36B) has a thickness of about 7000Å, since the second metal silicide (40A, 40B) is disclosed to have a thickness of 6000-12000Å.

Chung et al. does not disclose the composite structure having claimed range of a thickness of about 700Å to 1800Å. But it discloses a thickness for a local interconnect structure.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the thickness of the composite structure that forms the local interconnect as there is no statement denoting the criticality of the thickness and as the structure of Chung et al. provides a local interconnect structure with a low contact resistance while inhibiting the diffusion of the material to underlying layers.

“In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of “about 1-5%” while the claim was limited to “more than 5%.”

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The court held that “about 1-5%” allowed for concentrations slightly above 5% thus the ranges overlapped.)” (MPEP 2144.04)

Regarding claim 38, Chung et al. discloses in Fig. 1e a semiconductor device that comprises a substrate assembly having at least one semiconductor layer (10); at least one field effect transistor (22) formed in the at least one semiconductor layer (10), the field effect transistor (22) having a source (18), a drain (18), and a gate (22); and a local interconnect for connecting the source and drain of the field effect transistor to an active area, the local interconnect comprises a composite structure comprising a first refractory metal silicide (38A, 38B as disclosed in col. 5, lines 20-33), a second refractory metal silicide (40A, 40B as disclosed in col. 5, lines 50-66, and col. 7, lines 53-55), and an intermetallic compound (36A, 36B as disclosed in col. 4, lines 55-57) reducing the resistance of the local interconnect, wherein the intermetallic compound comprises refractory metal from the first refractory metal silicide (*in this case the first metal silicide is titanium silicide and the first metal is titanium as disclosed in col. 4, lines 55-57*) and refractory metal from the second refractory metal silicide (*in this case the second metal silicide is tungsten silicide and the second metal is tantalum as disclosed in col. 7, lines 53-55, and col. 4, lines 55-57*), wherein the intermetallic compound (36A, 36B) contains no non-metallic materials.

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Chung et al. discloses the claimed invention with the exception of teaching a memory array, and specifically disclosing what the local interconnect connects to.

Okamoto teaches in Fig. 4D an interconnect comprising a composite structure comprising a first metal silicide (4), a second metal silicide (8), and an intermetallic compound (10) comprising metal from the first metal silicide and metal from the second metal silicide; wherein the first metal silicide may comprise titanium silicide (*as disclosed in col. 4, l. 43*) and the second metal silicide may comprise tungsten silicide (*as disclosed in col. 6, l. 49-51*), and the intermetallic compound (10) comprises titanium tungsten (TiW) (*as disclosed in col. 6, l. 64-66*), and that the interconnect structure can be used in memory arrays, as memory arrays are well known to be LSI circuits and the structure of Okamoto is directed to LSI circuits.

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure be a memory array, and that the interconnections taught by Chung et al. be used in such structures as the use of interconnections in a memory array is well known to one of ordinary skill in the art and as Okamoto discloses the use of local interconnects in LSI circuits.

Regarding claims 39 and 40, Chung et al. discloses in Fig. 1E a plurality of interconnects (*formed by layers 40B, 36B, 34B, and 38B; 40A, 36A, 34A, 38A; and so*

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on) for connecting additional active areas (18, 26, 30) within the structure and to areas outside the structure.

Regarding claim 46, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide comprises titanium silicide and the second metal silicide comprises tungsten silicide.

Regarding claim 47, Chung et al. discloses in col. 4, lines 55-57 that the intermetallic compound comprises titanium tungsten.

Response to Arguments

6. Applicant's arguments filed 2/15/05 have been fully considered but they are not persuasive.

Regarding applicant's argument that the composite interconnect layer of Chung et al. is actually represented by items 40A to 40C in Chung's specification and drawings, it is noted that Chung et al. discloses the composite structures including items 40A to 40C but the composite structures are those which are formed by the stack of layers, items 40B, 36B, 34B, 38B forming one composite structure, items 40A, 36A, 34A, 38A forming another composite structure, and layer 40C and its respective underlying layers forming yet another composite structure, items 40A, 40B, and 40C are not exclusively a single composite structure.

Regarding applicant's argument that item 36B (or 36A) does not contain a metal from a first metal silicide and a metal from a second metal silicide, it is

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noted that Chung et al. discloses that item 36B comprises titanium tungsten, and that the first metal silicide 38B comprises titanium silicide and that as an alternative embodiment the second metal silicide comprises tungsten silicide (when used in lieu of aluminum) thus item 36B indeed comprises a metal from the first metal silicide, and a second metal from a second metal silicide.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ginette Peralta whose telephone

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number is (571)272-1713. The examiner can normally be reached on Monday to Friday 8:00 AM- 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571)272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

GP

Wael Fahmy
SRE 2814